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METHOD OF PRODUCTION OF A HOOK AND LOOP FASTENER

[*Men'fasunah no seizoh houhoh*]

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[There are no amendments to this patent.]

Specification

1. Title of the invention

Method of production of a hook and loop fastener

2. Claim of the invention

A method of production of a hook and loop fastener characterized by the fact that a hollow sheet-like material having many rows of hollow cells that run continuously in the longitudinal direction (MD) is prepared; processes A-D below are selected and used in combination so that at least one surface of the above-mentioned sheet-like material forms the base material of a hook and loop fastener, and at the same time, the top panel member and the partition wall member that comprises the roof of the hollow cells on the opposite side serve as the engagement element of the hook and loop fastener comprised of the rib head and rib column.

(A) Process A wherein slits (TD slits) are formed in the partition wall member that serves as the top panel member of partitions and the partition wall member that comprises the roof of hollow cells on at least one side of the surface sheet (X surface side) in the width direction (TD) perpendicular to the longitudinal (MD) direction.

(B) Process B wherein slits (MD slits) are formed in the top panel member of the surface sheet (X surface side) at the center of the member between adjacent partition wall members of the

above-mentioned sheet-like material in the longitudinal (MD) direction so as to form rows of slits along the partition wall members.

(C) Process C wherein drawing of the above-mentioned sheet-like material is done in the MD direction or in both the MD and TD directions under heat so as to increase the width of the slits, and the ribs of the sheet-like material are separated.

(D) Process D wherein a heat treatment is applied to at least a part of the above-mentioned sheet-like material.

3. Detailed description of the invention

<Field of industrial application>

The present invention pertains to a method of manufacturing a hook and loop fastener which has high performance with high productivity, and the method is very useful for production of the male member or female member of a hook and loop fastener.

<Prior art>

In the past, mainly woven tapes (woven material structure) have been used for hook and loop fasteners, but productivity is low and cost is high. On the other hand, production of a hook and loop fastener sheet having a mushroom-shaped or hook-shaped projections (hereinafter referred to as ribs) produced by resin molding using a continuous extrusion molding process (for example, Japanese Kokoku [Examined] Patent Application No. Sho 53-22889) has been proposed.

[p. 2]

<Problems to be solved by the invention>

In the above-mentioned manufacturing method and fasteners, the shape of the head member of the rib is restricted due to the shape of the die or the device used. For example, when the head of the rib has a block-like shape, the rigidity of the under side of the rib that forms the hook is high and removal of the fastener is difficult, when the shape of the head member of the rib is a two-dimensional shape, engagement strength is not sufficient; furthermore, production of fasteners with a wide width or at high speed is difficult, etc. and many problems need to be eliminated in the production of a hook and loop fasteners to achieve high performance and high productivity.

The present invention pertains to a manufacturing method of a hook and loop fastener with high performance that provides high productivity, and the invention further pertains to an efficient method of manufacturing a hook and loop fastener from a hollow-structured sheet having many continuous cells using an extrusion molding process, etc. Furthermore, the present invention is to provide a method of manufacturing a wide fastener with a solid molding surface having good durability for repeated use, and a solid molding surface having good engagement strength with surface fasteners other than woven loop fasteners.

<Means to solve the problem>

In the present invention, the head member of the ribs of many ribs in many rows of an independent hook and loop fastener are formed from the roofs of hollow chambers on one side (X surface side) of a continuous hollow sheet-like material as the top panel member and the rib column members are formed as the partition wall members ahead of time; subsequently, at least one surface (opposite side from the X surface) of the above-mentioned continuous hollow sheet-

like material having many rows of sections serves as the base, and at the same time, secondary processing is carried out for the top panel member and partition wall member at the other side of the sheet (X surface side), and used as the head of the rib and column of rib of a molded fastener.

In other words, basically, the present invention is a method of production of a hook and loop fastener characterized by the fact that a hollow sheet-like material having many rows of hollow cells that run continuously in the longitudinal direction (MD) is prepared; then processes A-D listed below are selected and used in combination so that at least one surface of the above-mentioned sheet-like material is formed into the base of a hook and loop fastener, and at the same time, the top panel member and the partition wall members that comprise the roof the hollow cells on the opposite side serve as the engagement elements of a hook and loop fastener comprising rib heads and rib columns.

(A) Process A wherein slits (TD slits) are formed in the partition wall member that serves as the top panel member of partitions and the partition wall member that comprises the roof of hollow cells on at least one side of the surface sheet (X surface side) in the width direction (TD) perpendicular to the longitudinal (MD) direction.

(B) Process B wherein slits (MD slits) are formed in the top panel member of the surface sheet (X surface side) at the center of the member between adjacent partition wall members of the above-mentioned sheet-like material in the longitudinal (MD) direction so as to form rows of slits along the partition wall members.

(C) Process C wherein drawing of the above-mentioned sheet-like material is done in the MD direction or in both the MD and TD directions under heat so as to increase the width of the slits, and the ribs of the sheet-like material are separated.

(D) Process D wherein a heat treatment is applied to at least a part of the above-mentioned sheet-like material.

In the present invention, the difficulty of producing an integrally molded hook and loop fastener having ribs with a functional shape and good engagement strength using a conventional injection molding process or extrusion molding process is eliminated and an efficient method of producing an integrally molded hook and loop fastener with a wide width is made possible.

<Application examples>

In the following, the present invention is explained in further detail with drawings.

Fig. 2 is a cross-section view that shows the engagement state of the rib members of an example of a hook and loop fastener (10) of a conventional integrally molded resin hook and loop fastener. The above-mentioned fastener (10) has engagement elements (4) comprising many rows of independent rib columns (2) having heads (3) on the end of the column on a base (1).

[p. 3]

In the above-mentioned conventional mushroom-shaped hook and loop fastener, the engagement member at the rib head(3), that is, the sleeve member of the rib sleeve (3-2) is narrow, and the root (3-1) of the arm is solid and rigidity is very high. Thus, once engaged with the engagement loops of the corresponding loop fastener member (20), a high engagement strength can be achieved but flexibility is poor and the fastener is stiff. Furthermore, upon removal of the corresponding fastener member (20), the sleeve of rib (3-2) does not easily undergo deformation and disengagement from the loops (23) is difficult. Therefore, rupturing of the loops or tearing of the columns from the base material takes place. Furthermore, in the above-mentioned fastener, the rib head is a solid mass and flexibility is poor at the sleeve of the rib; thus, the

engagement strength is poor when the corresponding fastener is an integrally molded hook and loop fastener.

Fig. 1 shows the perspective view of an example of a simple, typical integrally molded hook and loop fastener produced by the method of production of the present invention. In said hook and loop fastener, many rows of engagement elements (4) made of rib columns (2) and rib heads (3) are formed on at least one surface of base (1) and are integrally molded with base material (1). The hook and loop fastener in this application example has a flat rib head as shown in the cross-section view of the rib in Fig. 8, the sleeve of the ribs has flexibility, and unlike many conventional fasteners, the rib head is not a solid mass, and flexibility is good, and disengagement can be achieved easily. Furthermore, when the rib head (3) is bowed to form the shapes shown in Fig. 9 or Fig. 10 using known methods, the function can be improved further and production of a hook and loop fastener with high performance and good engagement strength is possible.

As an example of a method of production of the present invention, a method of manufacturing the integrally molded hook and loop fastener shown as an example in Fig. 1 is explained.

Fig. 3 is a perspective view that shows the hollow-structure sheet-like material having many continuous hollow cells in the longitudinal (MD) direction used as the pre-molding for the integrally molded hook and loop fastener. The above-mentioned sheet-like material is produced by extrusion molding, etc., and has a structure comprising surface member (1') on the lower side that forms the base of the hook and loop fastener, partition wall members (2') of the hollow chambers that form the rib columns and top panel member (3') that is the top (X surface side) of

the hollow chamber and forms the head of the rib. The above-mentioned hollow sheet-like material is an important and essential basic material required in the production method of the present invention. The material that comprises the above-mentioned hollow sheet-like material and the structure can be freely selected according to the performance required for the target hook and loop fastener.

In production of the rib heads and the rib columns from the above-mentioned hollow sheet-like material, first, TD slits (5) are formed in the top panel member (3') and partition wall members (2') perpendicular to the longitudinal direction (MD) in the width direction (TD). In general, the TD slits are formed in the rib member to a point near the base material surface, and the slit can be formed with a certain width in the longitudinal direction as well. The above-mentioned TD slitting process is one of the basic processes of the manufacturing method of the present invention and is hereinafter referred to as process A. When the TD slitting process A is simply a slitting process, a drawing process in the longitudinal direction (process C) described below is required to produce independent engagement elements that serve as fastener elements since the partition wall member is continuous.

Subsequently, in order to separate the partition wall member of the hollow cells on the X surface side and top panel member (3') and adjacent partition wall members for each row of the rib, MD slits (6) are made along the many rows of partition wall members (process B). As in the case of the above-mentioned TD slitting process, the MD slits are made as described above or removal of a part of the top panel member can be done for a certain width. When a simple slitting process is used, a drawing process in the width direction (process C) is required.

After the TD slitting process or TD-MD slitting process, heating of the above-mentioned

hollow sheet-like material and drawing is done in the lengthwise direction or width direction or biaxial drawing is carried out in both the lengthwise direction and the width direction so as to separate the individual ribs. The above process is process C, and is a basic process selected in the manufacturing method of the present invention. Furthermore, in the manufacturing method of the present invention, the above-mentioned process A, process B, and process C are not limited to the above examples, and the combination of processes and the order of the processes can be changed.

[p. 4]

For example, the order of the above-mentioned processes can be changed freely to increase the performance or to increase productivity or to change the resin used or the shape of the fastener, or equipment used, etc.

Incidentally, when the MD slitting process is omitted in the example shown in Fig. 3 and drawing is done for the TD slitting process alone, in other words, when processes B and C are used, the top panel member (3') forms an arch and a continuous rib head is formed as shown in Fig. 4, and when MD slitting is provided for the above-mentioned arch to produce a fastener as in the case of the example shown in Fig. 1 or the top panel member can be used as an engagement element as is, as well. Typical combinations of processes used are A-B-C, A-B, A-C-B and A-C.

Each application example of the above-mentioned production processes of A, B and C are explained above, and as additional processes of the manufacturing method of the hook and loop fastener of the present invention, a heat treatment process, coating process, plating process, or lamination process to produce a composite with another material such as a metal tape, etc. can be included as well.

Furthermore, the resin used in the manufacturing method is a thermoplastic resin, and resins with good extrusion or injection molding properties, for example, polyamide resins, polypropylene resins, polystyrene resins, polyethylene terephthalate resins, polyester resins, polyacetal resins, polyethylene resins, polybutylene terephthalate resins, polyurethane resins, ABS resins, varieties of rubbers, polyvinyl chlorides, acrylic resins, polycarbonate resins, silicone rubbers, various resin alloys, resin elastomers, etc. can be used effectively, and resins containing a variety of additives such as coloring materials, plasticizers, flame retardants, antistatic agents, conductive materials and weather resistance agents can be used as well.

In the following, some embodiments of the present invention are described.

First, examples of arrangement of the rib heads are explained below.

Fig. 5 is a top view of the hook and loop fastener shown in Fig. 1 observed from the rib head side, and is a simple arrangement of ribs where columns of wedge-shaped ribs (3) are arranged in parallel.

The simple arrangement of Fig. 5 is improved in Fig. 6, and in order to improve the performance, the TD slit in the process A is done diagonally, and an increase in the engagement performance can be achieved based on this arrangement of the ribs and the shape of the rib head. Fig. 7 shows a top view also, and in this case, two more slits are formed in addition to the line in TD direction of the rib head. In this case, slits on the surface of the top panel member of the rib head alone are shown and the rib column is barely slit if at all. When the above-mentioned auxiliary TD slits are made, a further improvement in the engagement force and increased flexibility can be achieved.

In the following, different embodiments of the rib shape are explained.

Fig. 8 is a vertical cross-section view of the rib member of the example shown in Fig. 1. Rib head (3) is formed integrally with rib column (2) and base (1), and the space S between rib heads is not especially limited.

Furthermore, the rib head is nearly flat, thus, good flexibility and detachment characteristics based on the shape of the sleeve of the rib (3-2) and rib root (3-1) can be achieved in comparison to fasteners of the prior art, but difficulty in disengagement poses a problem. When bow is applied to the rib head as in the improved version shown in Fig. 9 and Fig. 10, the above-mentioned problem can be eliminated. In other words, Fig. 9 shows an example where a permanent deformation is applied to the sleeve of rib (3-2) using a method such as heat treatment, and the difficulty of disengagement can be improved significantly. Furthermore, Fig. 10 shows the vertical cross-section view of an example of an improvement where base (1) and rib head (3) are each compounded of two different types of resins. In this case, the base material has a structure comprising a resin with good adhesion (1B) and a resin with high flexibility (1A) and the rib head comprises resin (3A) and resin (3B) having different thermal shrinkage factors so as to accommodate thermal processing, and the fastener performance is improved. It is very difficult to achieved the above-mentioned compounding when conventional molding methods such as extrusion molding or injection molding where rib heads are formed as non-continuous rib heads, but the process can be easily achieved according to the method of the present invention where the rib heads are formed as an integral sheet as shown in Fig. 13 using methods such as multilayer coextrusion, coating, or a lamination process.

[p. 5]

In the following, different embodiments of the raw material, hollow sheet-like material are described.

In comparison to the flat, uniform structure shown in the example of Fig. 3, Fig. 11, and Fig. 12 shows a cross-section view of a sheet-like material having a top panel member (3') with a different shape. When the above-mentioned hollow sheet-like material is used, hook and loop fasteners with a different engagement performance can be produced.

Fig. 14 is a cross-section view that shows an example where a hollow-structure (7) in the partition wall member (2') used for the column of ribs or the intercellular area (7) is filled with a soft resin.

Fig. 15 and Fig. 16 show vertical cross-section views of hollow sheets where double hollow sheets are used for the upper surface and the lower surface of the base material, and base material (1') is formed at the center, partition wall members (2') and (2") are formed in each layer, and the top and bottom are formed by top panel members. The above-mentioned double-faced fastener can be produced according to the manufacturing method of the present invention.

Furthermore, Fig. 17 is a different example of the hollow sheet-like material used in the present invention, and shows that it is not necessary to use a flat sheet-like material. In other words, a cylindrical material produced by extrusion or vacuum sizing cooling method is included in the sheet-like material of the present invention.

Fig. 18 is an example of a schematic process diagram of the production device used in the present invention. Hollow sheet-like material die (120) is installed on extruder (110), the extruded polymer sheet (100) is guided to sizing cooling device (130) to produce a hollow sheet-like material and solidified, slitting is carried out to impart TD slits by slitter (150) as the sheet is

being taken-up by take-up machine (140) (process A), then, slitting is carried out to impart MD slits by slitter (160) (process B), drawing is done by drawing machine (170) under heat, and cooling is provided by cooling device (180) (process C) so as to produce the integrally molded hook and loop fastener such as the example shown in Fig. 2, and received by receiving machine (190).

<Effect of the invention>

The feature of the present invention is the pre-molding of the rib head into an integrally molded sheet. Thus, compounding of rib head, which is an important factor for engagement of the hook and loop fastener, and control of the shape of rib head can be easily achieved; furthermore, a wide sheet can be easily produced and productivity can be increased, and an increase in new applications can be expected.

4. Brief description of figures

Fig. 1 is a perspective view of an example of the hook and loop fastener produced by an application example of the present invention; Fig. 2 is a cross-section view that shows the engagement state of the rib heads of an integrally molded hook and loop fastener made of a resin by conventional methods; Fig. 3 is a perspective view that shows a hollow sheet-like material; Fig. 4 is a perspective view of the intermediate material of a hook and loop fastener where drawing is done after TD slitting alone; Fig. 5 through Fig.7 are top views showing examples of arrangements of the rib heads of hook and loop fasteners; Fig. 8 through Fig. 10 are vertical cross-section views of the hook and loop fastener of the present invention; Fig. 11 through Fig. 16 are vertical cross-section views of sheet-like materials used in the present invention; Fig. 17 is

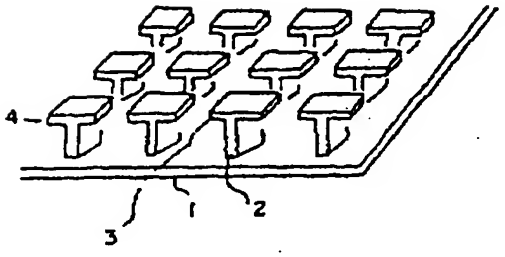
a perspective view that shows a modified sheet-like material used in the present invention; and

Fig. 18 is a process diagram that shows an example of the production machine used in the present invention.

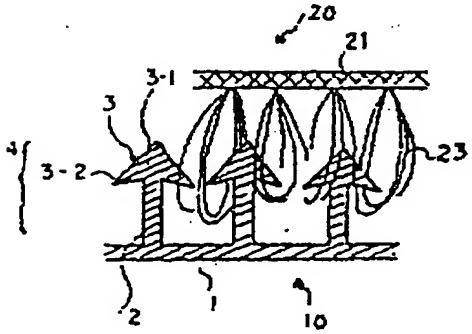
Explanation of codes

1 ... Base material
1' ... Base material surface
2 ... column of rib
2', 2" ... partition wall member
3 ... rib head
3', 3" ... top panel member
4 ... Engagement element
5 ... TD slit
6 ... MD slit
7 ... Hollow member
10 ... integrally molded hook and loop fastener
20 ... Loop of hook and loop fastener
21 ... Base material
23 ... Engagement loop
100 ... Polymer sheet
110 ... Extruder
120 ... Extrusion die for hollow sheet-like material
130 ... Sizing cooling device
140 ... Take-up machine
150, 160 ... Cutters
170 ... Drawing machine
180 ... Cooling machine
190 ... Receiving machine

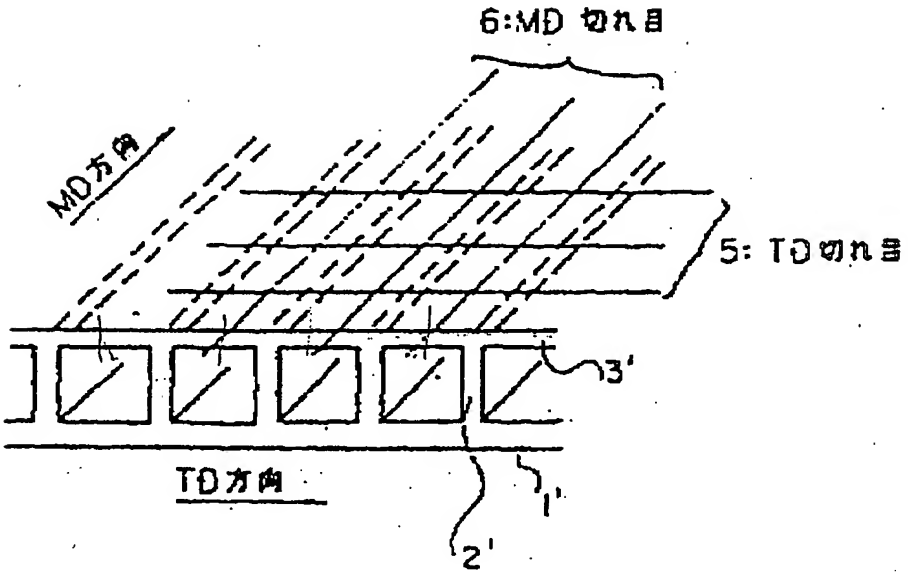
[Fig. 1]



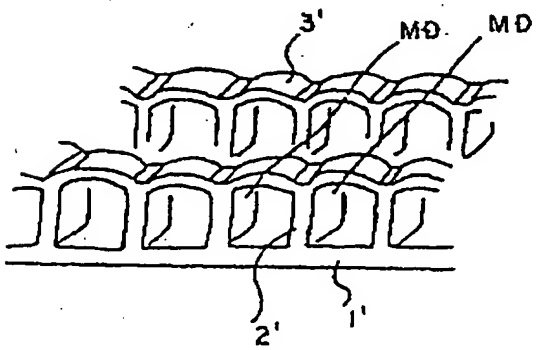
[Fig. 2]



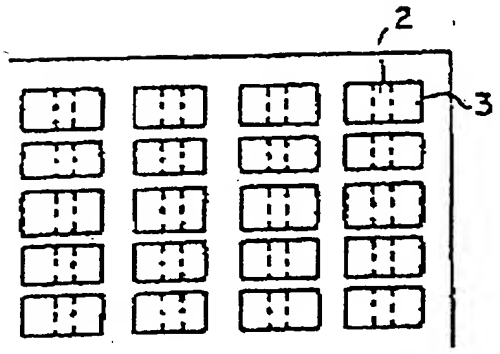
[Fig. 3]



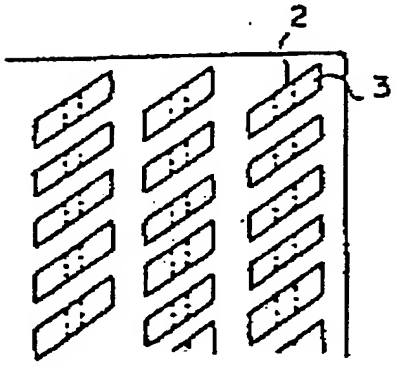
[Fig. 4]



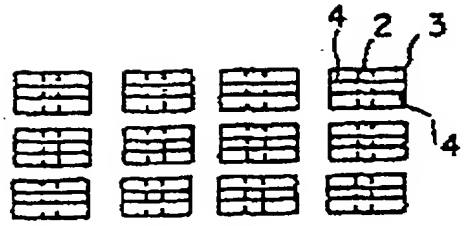
[Fig. 5]



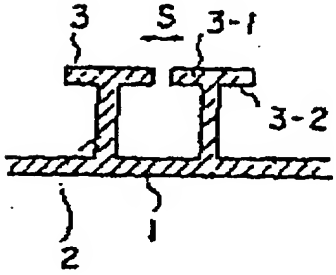
[Fig. 6]



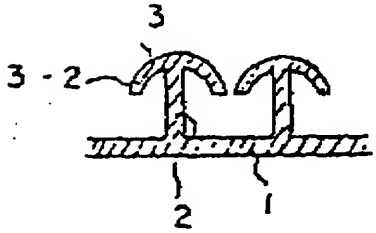
[Fig. 7]



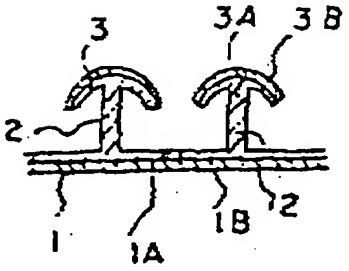
[Fig. 8]



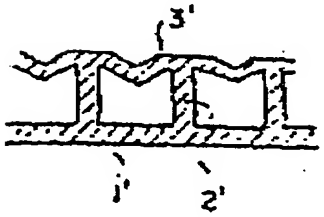
[Fig. 9]



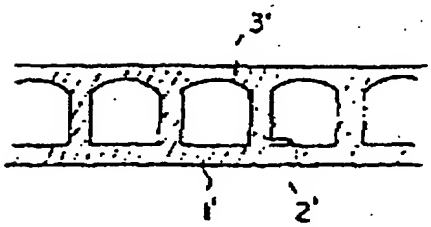
[Fig. 10]



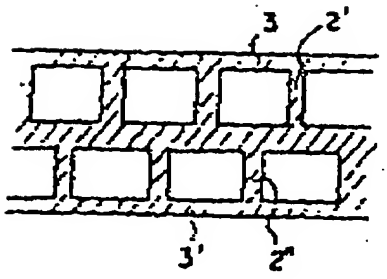
[Fig. 11]



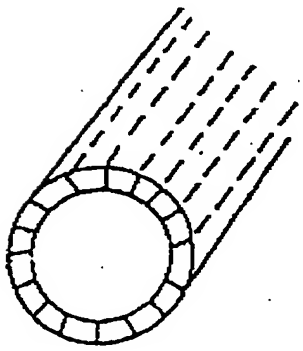
[Fig. 12]



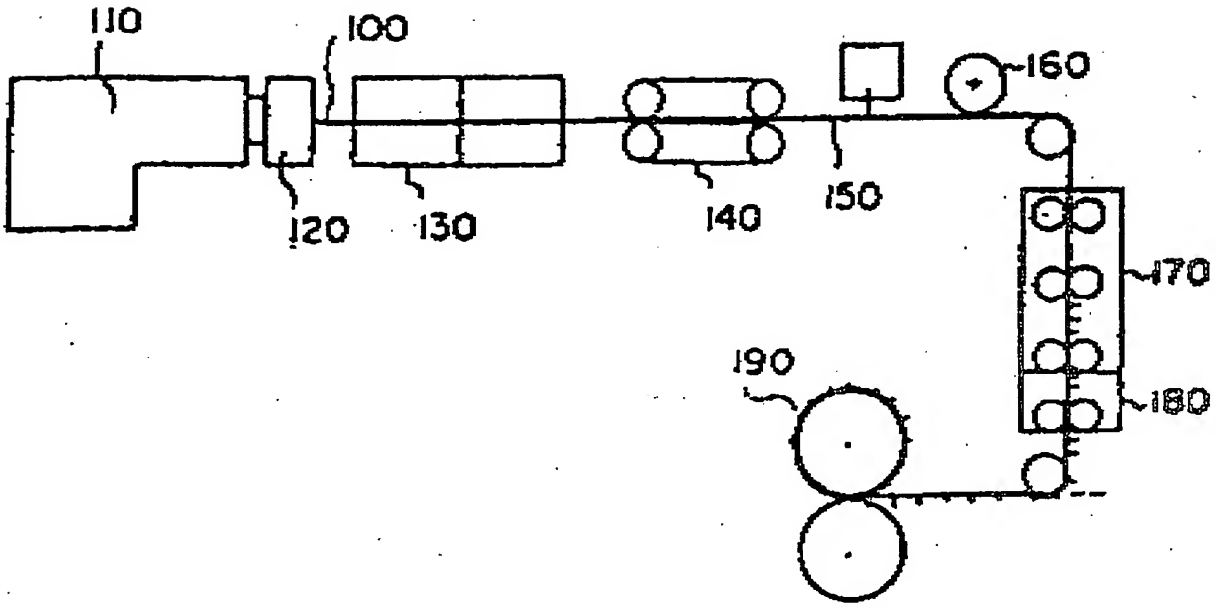
[Fig. 16]



[Fig. 17]



[Fig. 18]



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